

Birthday Problem & Monty Hall Game

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Birthday Problem

```
set.seed(200)
n <- 100 #people in room
triple <- 0 #counter for room with one or more 3+ matches
numberofruns <- 10000
for(i in 1:numberofruns){
  birthdays <- sample(365, n, replace = TRUE)
  #This is a frequency table of birthdays to see if any day occurs 3 or more times
  if (max(table(birthdays)) >= 3){
    triple <- triple + 1 # room found with at least one triple
  }
}

#Calculate and print estimated probability
p_triple <- triple / numberofruns
print(p_triple)
```

```
[1] 0.6438
```

The Monty Hall Game

```
set.seed(100)
numberofruns <- 100000

wins_if_stay <- 0 #starting with zero wins for 'stay' approach
wins_if_switch <- 0 #starting with zero wins for 'switch' approach

for (t in seq_len(numberofruns)) {
  # randomly place car behind one of the three doors
  car <- sample(1:3, 1)
  # contestant picks a door randomly
  pick <- sample(1:3, 1)

  # host opens a door that is not the contestant pick and does not have the car
  # If there are two possible doors host can open, he chooses one of them.
  remaining <- setdiff(1:3, c(pick, car))
  if (length(remaining) == 0) {
    # contestant picked car; host opens one of the two doors with a goat
    hostopensdoor <- sample(setdiff(1:3, pick), 1)
  } else {
    # there is exactly one door that is neither contestant pick nor the car, host opens it
```

```
    hostopensdoor <- remaining[1]
  }

  # the door available to switch to is the one not pick and not host_opens
  switch_to <- setdiff(1:3, c(pick, hostopensdoor))

  # if staying, you win if your original pick is car
  if (pick == car) wins_if_stay <- wins_if_stay + 1
  # if switching, you win if the other door that is unopened has the car
  if (switch_to == car) wins_if_switch <- wins_if_switch + 1
}

p_stay <- wins_if_stay / numberofruns
p_switch <- wins_if_switch / numberofruns

print(paste0("P(win if stay)   = ", round(p_stay, 6)))
```

```
[1] "P(win if stay)   = 0.33438"
```

```
print(paste0("P(win if switch) = ", round(p_switch, 6)))
```

```
[1] "P(win if switch) = 0.66562"
```